This key should allow you to understand why you choose the option you did (beyond just getting a question right or wrong). More instructions on how to use this key can be found here.

If you have a suggestion to make the keys better, please fill out the short survey here.

Note: This key is auto-generated and may contain issues and/or errors. The keys are reviewed after each exam to ensure grading is done accurately. If there are issues (like duplicate options), they are noted in the offline gradebook. The keys are a work-in-progress to give students as many resources to improve as possible.

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1. Choose the **smallest** set of Real numbers that the number below belongs to.

$$\sqrt{\frac{52900}{100}}$$

The solution is Whole, which is option A.

A. Whole

* This is the correct option!

B. Integer

These are the negative and positive counting numbers (..., -3, -2, -1, 0, 1, 2, 3, ...)

C. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3)

D. Irrational

These cannot be written as a fraction of Integers.

E. Not a Real number

These are Nonreal Complex numbers **OR** things that are not numbers (e.g., dividing by 0).

General Comment: First, you **NEED** to simplify the expression. This question simplifies to 230.

Be sure you look at the simplified fraction and not just the decimal expansion. Numbers such as 13, 17, and 19 provide **long but repeating/terminating decimal expansions!**

The only ways to *not* be a Real number are: dividing by 0 or taking the square root of a negative number.

Irrational numbers are more than just square root of 3: adding or subtracting values from square root of 3 is also irrational.

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2. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(-4 - 5i)(7 + 9i)$$

The solution is $17 - 71i$, which is option A.

A. $a \in [17, 26]$ and $b \in [-74, -65]$

* $17 - 71i$, which is the correct option.

B. $a \in [-31, -20]$ and $b \in [-48, -42]$

$-28 - 45i$, which corresponds to just multiplying the real terms to get the real part of the solution and the coefficients in the complex terms to get the complex part.

C. $a \in [-77, -70]$ and $b \in [0, 2]$

$-73 + i$, which corresponds to adding a minus sign in the second term.

D. $a \in [-77, -70]$ and $b \in [-5, 0]$

$-73 - i$, which corresponds to adding a minus sign in the first term.

E. $a \in [17, 26]$ and $b \in [71, 78]$

$17 + 71i$, which corresponds to adding a minus sign in both terms.

General Comment: You can treat i as a variable and distribute. Just remember that $i^2 = -1$, so you can continue to reduce after you distribute.

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3. Simplify the expression below and choose the interval the simplification is contained within.

$$13 - 1 \div 4 * 2 - (7 * 20)$$

The solution is -127.500, which is option C.

A. $[109.29, 110.17]$

110.000, which corresponds to not distributing a negative correctly.

B. $[-127.31, -126.91]$

-127.125, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

C. $[-127.51, -127.25]$

* -127.500, which is the correct option.

D. $[152.53, 153.05]$

152.875, which corresponds to not distributing addition and subtraction correctly.

E. None of the above

You may have gotten this by making an unanticipated error. If you got a value that is not any of the others, please let the coordinator know so they can help you figure out what happened.

General Comment: While you may remember (or were taught) PEMDAS is done in order, it is actually done as P/E/MD/AS. When we are at MD or AS, we read left to right.

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4. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\frac{2}{8} + \sqrt{-4}i$$

The solution is Rational, which is option A.

A. Rational

* This is the correct option!

B. Not a Complex Number

This is not a number. The only non-Complex number we know is dividing by 0 as this is not a number!

C. Pure Imaginary

This is a Complex number $(a + bi)$ that **only** has an imaginary part like $2i$.

D. Nonreal Complex

This is a Complex number $(a + bi)$ that is not Real (has i as part of the number).

E. Irrational

These cannot be written as a fraction of Integers. Remember: π is not an Integer!

General Comment: Be sure to simplify $i^2 = -1$. This may remove the imaginary portion for your number. If you are having trouble, you may want to look at the *Subgroups of the Real Numbers* section.

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5. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(-10 - 6i)(5 - 8i)$$

The solution is $-98 + 50i$, which is option D.

A. $a \in [-3, 0]$ and $b \in [108.8, 113]$

$-2 + 110i$, which corresponds to adding a minus sign in the first term.

B. $a \in [-99, -97]$ and $b \in [-52.5, -49.9]$

$-98 - 50i$, which corresponds to adding a minus sign in both terms.

C. $a \in [-3, 0]$ and $b \in [-112.2, -107.1]$

$-2 - 110i$, which corresponds to adding a minus sign in the second term.

D. $a \in [-99, -97]$ and $b \in [48.4, 50.8]$

* $-98 + 50i$, which is the correct option.

E. $a \in [-52, -43]$ and $b \in [46.2, 48.4]$

$-50+48i$, which corresponds to just multiplying the real terms to get the real part of the solution and the coefficients in the complex terms to get the complex part.

General Comment: You can treat i as a variable and distribute. Just remember that $i^2 = -1$, so you can continue to reduce after you distribute.

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6. Simplify the expression below and choose the interval the simplification is contained within.

$$5 - 18^2 + 14 \div 1 * 19 \div 4$$

The solution is -252.500, which is option C.

A. $[327.18, 332.18]$

329.184, which corresponds to two Order of Operations errors.

B. $[-325.82, -316.82]$

-318.816, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

C. $[-255.5, -250.5]$

* -252.500, this is the correct option

D. $[395.5, 401.5]$

395.500, which corresponds to an Order of Operations error: multiplying by negative before squaring. For example: $(-3)^2 \neq -3^2$

E. None of the above

You may have gotten this by making an unanticipated error. If you got a value that is not any of the others, please let the coordinator know so they can help you figure out what happened.

General Comment: While you may remember (or were taught) PEMDAS is done in order, it is actually done as P/E/MD/AS. When we are at MD or AS, we read left to right.

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7. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{-36 - 88i}{2 - 6i}$$

The solution is $11.40 - 9.80i$, which is option B.

A. $a \in [-15.5, -14]$ and $b \in [0, 1.5]$

$-15.00 + i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

B. $a \in [9.5, 11.5]$ and $b \in [-10.5, -9]$

* $11.40 - 9.80i$, which is the correct option.

C. $a \in [-19, -17]$ and $b \in [13.5, 15]$

$-18.00 + 14.67i$, which corresponds to just dividing the first term by the first term and the second by the second.

D. $a \in [9.5, 11.5]$ and $b \in [-393, -391]$

$11.40 - 392.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

E. $a \in [455, 456.5]$ and $b \in [-10.5, -9]$

$456.00 - 9.80i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

General Comment: Multiply the numerator and denominator by the *conjugate* of the denominator, then simplify. For example, if we have $2 + 3i$, the conjugate is $2 - 3i$.

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8. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\frac{\sqrt{110}}{14} + 5i^2$$

The solution is Irrational, which is option D.

A. Pure Imaginary

This is a Complex number $(a + bi)$ that **only** has an imaginary part like $2i$.

B. Not a Complex Number

This is not a number. The only non-Complex number we know is dividing by 0 as this is not a number!

C. Nonreal Complex

This is a Complex number $(a + bi)$ that is not Real (has i as part of the number).

D. Irrational

* This is the correct option!

E. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3 + 5)

General Comment: Be sure to simplify $i^2 = -1$. This may remove the imaginary portion for your number. If you are having trouble, you may want to look at the *Subgroups of the Real Numbers* section.

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9. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{36 - 55i}{-1 - 8i}$$

The solution is $6.22 + 5.28i$, which is option E.

A. $a \in [-37, -35]$ and $b \in [6, 8]$

$-36.00 + 6.88i$, which corresponds to just dividing the first term by the first term and the second by the second.

B. $a \in [6, 7]$ and $b \in [342.5, 343.5]$

$6.22 + 343.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

C. $a \in [-8, -6]$ and $b \in [-4.5, -2]$

$-7.32 - 3.58i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

D. $a \in [403.5, 404.5]$ and $b \in [4.5, 6]$

$404.00 + 5.28i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

E. $a \in [6, 7]$ and $b \in [4.5, 6]$

* $6.22 + 5.28i$, which is the correct option.

General Comment: Multiply the numerator and denominator by the *conjugate* of the denominator, then simplify. For example, if we have $2 + 3i$, the conjugate is $2 - 3i$.

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10. Choose the **smallest** set of Real numbers that the number below belongs to.

$$\sqrt{\frac{1540}{10}}$$

The solution is Irrational, which is option B.

A. Integer

These are the negative and positive counting numbers (..., -3, -2, -1, 0, 1, 2, 3, ...)

B. Irrational

* This is the correct option!

C. Whole

These are the counting numbers with 0 (0, 1, 2, 3, ...)

D. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3)

E. Not a Real number

These are Nonreal Complex numbers **OR** things that are not numbers (e.g., dividing by 0).

General Comment: First, you **NEED** to simplify the expression. This question simplifies to $\sqrt{154}$.

Be sure you look at the simplified fraction and not just the decimal expansion. Numbers such as 13, 17, and 19 provide **long but repeating/terminating decimal expansions!**

The only ways to *not* be a Real number are: dividing by 0 or taking the square root of a negative number.

Irrational numbers are more than just square root of 3: adding or subtracting values from square root of 3 is also irrational.
